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ABSTRACT

The National Science Foundation (NSF), in collaboration with 24 states and one territory, is engaged in a multi-year effort to improve the quality of mathematics, science, and technology education for all students in a systemic way. The goal of the Statewide Systemic Initiatives (SSI) is to develop broad strategies for coordinating or aligning state-level initiatives and policies in curriculum, assessment, teacher education, professional development, and other key components of educational change. In order to assist other states seeking to implement system-wide reform, this report provides a brief glimpse of some of the SSI strategies that are positively changing teaching and learning in mathematics, science, and technology education. The strategies included are in the following areas: addressing the needs of policy makers, enriching cooperation and collaboration among educators, and sustaining the scale-up of reform. (JRH)

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SCALING UP MATHEMATICS SCIENCE AND TECHNOLOGY EDUCATION REFORM

STRATEGIES FROM THE NATIONAL SCIENCE FOUNDATION'S STATEWIDE SYSTEMIC INITIATIVES

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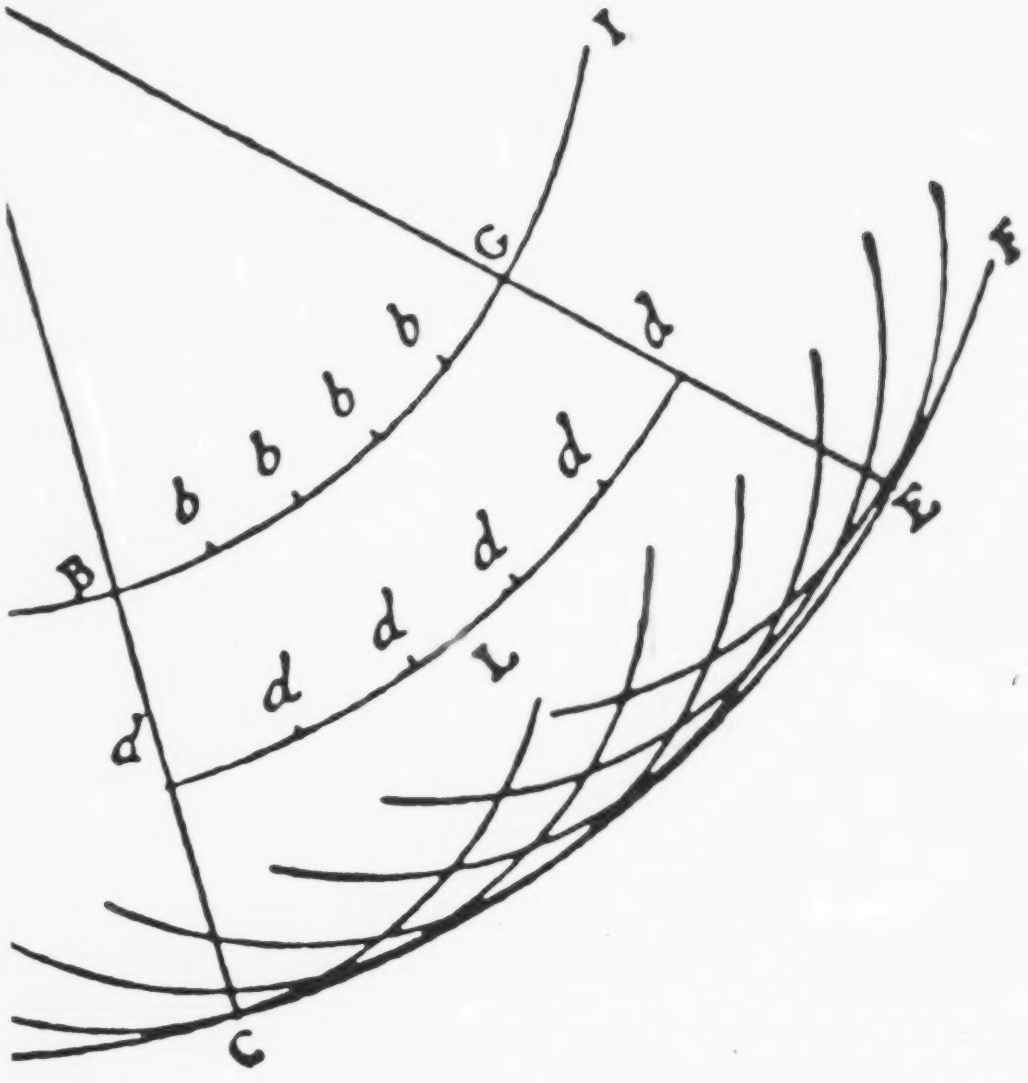
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SCALING-UP MATH SCIENCE AND TECHNOLOGY EDUCATION REFORM

STRATEGIES FROM THE NATIONAL SCIENCE FOUNDATION'S STATEWIDE SYSTEMIC INITIATIVES

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INTRODUCTION

The National Science Foundation (NSF), in collaboration with 24 states and one territory, is engaged in a multi-year effort to improve the quality of mathematics, science and technology (MST) education for all students in a systemic way. Unlike past efforts that have focused on piecemeal changes and discrete innovations in curriculum, teaching and learning, systemic change invites — in fact, requires — a comprehensive vision of reform.

One of NSF's charges to its 25 partners — the Statewide Systemic Initiatives (SSIs) — is to develop broad *strategies* for coordinating or aligning state-level initiatives and policies in curriculum, assessment, teacher education, professional development and other key components of educational change. Through effective partnerships that cut across existing organizational lines, the SSIs seek to engage and empower the principal stakeholders in mathematics and science education and link them with others throughout the system. The intended result is a statewide legacy of strong mathematics, science and technology education for all students.

The National Science Foundation has been generous in its support (up to $10 million in funding over a five-year period for each SSI) recognizing that the process of changing MST education in a systemic manner is an enormous undertaking, in both scope and challenge. To effectively meet their charge, the SSIs must develop and implement strategies which:

- Describe a widely shared vision of mathematics, science and technology reform in a state
- Align state and local policies to support the vision
- Create partnerships that enable the SSI to succeed
- Increase the number of classrooms which have high quality MST instruction
- Evaluate the work of the SSI effectively both to promote support for the work and to provide information for mid-course corrections and
- Garner the support needed to sustain the reforms after the five-year funding period.

These challenges have inspired innovative, creative and entrepreneurial approaches from the leadership of the SSIs. Although the SSIs are at different stages of implementation, all are actively engaged in the work of systemic change. The SSIs are developing and implementing a wide range of strategies affecting the entire education system to support the "scale-up" of their reforms. Scale-up refers to the process of increasing dramatically the number of schools and classrooms with high quality mathematics, science and technology teaching and learning.

In order to assist other states seeking to implement system-wide reform, this report provides a brief glimpse of some of the SSI strategies that are positively changing teaching and learning in mathematics, science and technology education. The highlighted strategies were identified and described by the leadership of the 25 SSIs.

These SSI strategies are organized by a framework developed by the Education Commission of the States (ECS) on the basis of its work with large-scale reform efforts, including Re:Learning and the SSIs. It can provide a useful guidepost to policymakers and others as they seek to assure a maximum return on their investment in education reform.

The framework consists of ten strategies for scale-up grouped into three categories, with the understanding that none of the strategies is as strong in isolation as when combined with others in the context of a *comprehensive and sustained* reform effort.

ADDRESSING THE NEEDS OF POLICYMAKERS & THEIR CONSTITUENTS

- Building public and political support for mathematics, science and technology reform
- Aligning state and local policy to support mathematics, science, and technology education reform
- Improving the dissemination of available information resources to a larger number of constituents

ENRICHING THE COOPERATION & COLLABORATION AMONG EDUCATORS

- Creating vital connections among ongoing education reform efforts within a state to maximize the benefit of each and eliminate unnecessary duplication of effort
- Identifying existing reforms that are improving student learning and facilitating their scale-up to a greater number of children. Using existing resources efficiently to support the scale-up of mathematics, science and technology reform
- Designing effective structures for continuous communication between and among schools in an era of local control and decentralization
- Building the capacity of teachers and administrators through effective models of professional development

CONFIRMING THE SUCCESS & SUSTAINING THE SCALE-UP OF REFORMS

- Assuring equitable outcomes and opportunities for all students
- Collecting and disseminating evidence that demonstrates the potential and success of various mathematics, science and technology reforms
- Ensuring long term financial support for scale-up

ADDRESSING THE NEEDS OF POLICYMAKERS & THEIR CONSTITUENTS

STRATEGY BUILDING PUBLIC AND POLITICAL SUPPORT FOR MATHEMATICS, SCIENCE AND TECHNOLOGY REFORM

Several SSIs recognized early in the planning process that their efforts would not succeed unless the general public understood both the current state of mathematics and science education and also why systemic reform was essential to improving learning results for students. Most states held information sessions; other created publications which captured the interest, imagination, and ultimately, the support of a growing number of citizens.

NEBRASKA MATH & SCIENCE INITIATIVE

The Nebraska Math and Science Initiative (NMSI) pioneered the practice of training teachers and other key stakeholders to conduct town meetings, brown-bag lunches at corporate worksites and small, informal meetings with PTOs and other parent groups. Teachers were often unable to make presentations at the times desired, so NMSI created regional coalitions as the primary public contact point.

HOW: In its beginning stages, NMSI recruited teachers to participate in an Ambassador Program with the goal of promoting ongoing MST activities within the state and informing various community groups about the need for mathematics and science reform. Ambassadors used a videotape and an outline of a presentation to support their efforts. In 1994, the NMSI, in collaboration with key policymakers and education leaders, created seven regional coalitions to serve as the coordination and dissemination centers for information about SSI activities. Coalition directors now serve as the primary Ambassadors statewide, drawing on teachers for presentations whenever classroom schedules allow. The smaller group, well informed about NMSI activities and reform issues, has become a more consistent and available team of Ambassadors for the NMSI. The NMSI created a new video and brochure in 1994 for directors to use and make available to others.

Another SSI that has invested considerable time and energy into a successful person to person outreach program is Maine. One of Maine's strategies is to establish seven Beacon Centers throughout the state. In addition to providing direct support to K-12 schools and institutions of higher education, these Beacon Centers are now charged with promoting public participation within their regions. Given Maine's diverse geography, these Beacon Centers are critical to engage citizens from the more remote parts of the state in mathematics and science reform. Despite geographic limitations, however, all of the Beacon Centers are closely aligned, using technology and continuous communication to further the project goals.

HOW: The Beacon Centers serve the seven regions as centers of professional development, liaisons between K-12 systems and institutions of higher education and now, increasingly, as the community outreach infrastructure. Community action teams assure a steady flow of information from the seven SSI Beacon Centers to their local constituencies. The Maine Mathematics and Science Alliance and the Beacon Centers coordinate training for these teams of educators, administrators and parents at each of the Beacon Centers. Once trained, these small groups of volunteers will engage community organizations, local businesses, and even local parent or senior groups in inquiry activities such as Family Math or Family Science to promote interest in MST education.

The goal of the Ambassador and Beacon strategies is to provide substantive information to parents and the general public; to communicate effectively about why educational change is necessary and why isolated reform activities will not result in the same benefits as broader scale-up. In short, the strategies aim to build demand for systemic reform. Both states continuously track public opinion and support for reform of mathematics, science and technology education.

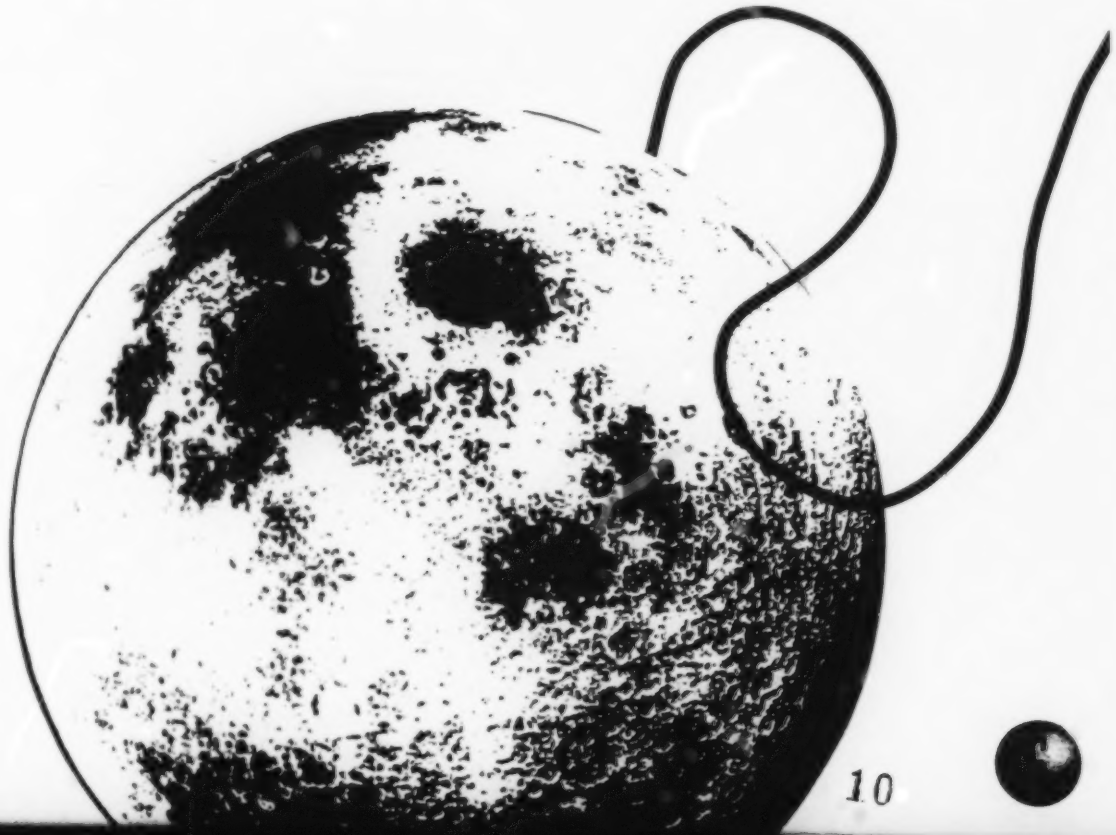
Printed material also is key to successful public discussions about mathematics, science and technology reform. In South Carolina, the SSI's efforts to engage public support for education reform include the publication of a highly informative and engaging brochure.

HOW: The brochure and related activities were sponsored by the South Carolina Governor's Office, the Governor's Mathematics and Sciences Advisory Board, the state legislature and both the South Carolina Department of Education and the Commission on Higher Education. The brochure clearly outlines both the goals of the SSI and the strategies that will be pursued in the drive toward systemic reform. The SSI subcontracted the entire public awareness campaign to a professional advertising group for their marketing expertise and ability to communicate in plain language.

NORTH CAROLINA
Science and Mathematics
ALLIANCE

While several states make materials and speakers available to community groups and local businesses, the North Carolina Science and Mathematics Alliance has created a unique context for this exchange that also allows teachers to spend a greater amount of time in businesses and industries.

HOW: Teachers may apply for and receive short periods of release time from their regular teaching assignments to interact with local employers, learning what skills — particularly in the areas of mathematics and science — graduates will need in order to enter the local workforce. While the educators are receiving "shop floor" experience, they also have the opportunity to discuss with employers and education constituents many of the critical education issues facing the state, from literacy to drop-out rates. This ongoing exchange between the teachers and the employers of recent graduates leads to a significant and demonstrable increase in the level of collaboration between schools and the community and enriches the support for education reform. Several of the regional SSI centers have also created programs that allow teachers to use the last non-student contact days of the academic year to work closely with several of the larger North Carolina employers. This collaboration produces strategies that will lead to greater participation and achievement in mathematics and science courses, particularly for students who have not been encouraged to enroll in such classes previously.



One of the most complex and pressing challenges facing the SSIs is addressing the barriers or limitations to proposed reforms that exist in current policy. Many of the SSIs have made considerable progress, especially in the areas of curriculum and standards. But all state policy needs to be aligned to support the achievement of high standards by all students. This alignment requires increased dialogue among and between policymakers and all parts of the system where policy impacts classroom practice.

The New Mexico Statewide Initiative in Mathematics and Science Education (SIMSE) continues to build on its initial goal of developing exemplary models of systemic change through its own work and through coordinated efforts with the New Mexico Systemic Change in Education Work Group and New Mexico's Education 2000 panel.

HOW: SIMSE leadership is strategically placed on the statewide commissions and task groups involved with systemic change. Members of the SIMSE staff make their time and expertise available to legislators and education policy leaders actively involved in the work of New Mexico's Education 2000 Panel and the Systemic Change in Education Work Group. One SIMSE leader serves as a member of the New Mexico Education 2000 Panel. Another serves as the Department of Education manager leading the state's effort to address Goals 2000. Additionally, other SIMSE staff fill crucial roles in the development of mathematics and science learning frameworks. Beyond helping to provide the human resources critical to the success of these various efforts, SIMSE contributed $50,000 to support the development of the frameworks. SIMSE staff support implementation of the frameworks in SIMSE schools and provide technical assistance to others interested in implementing the frameworks.

9 STEP IMPROVING THE DISSEMINATION OF AVAILABLE INFORMATION RESOURCES TO A LARGER NUMBER OF CONSTITUENTS

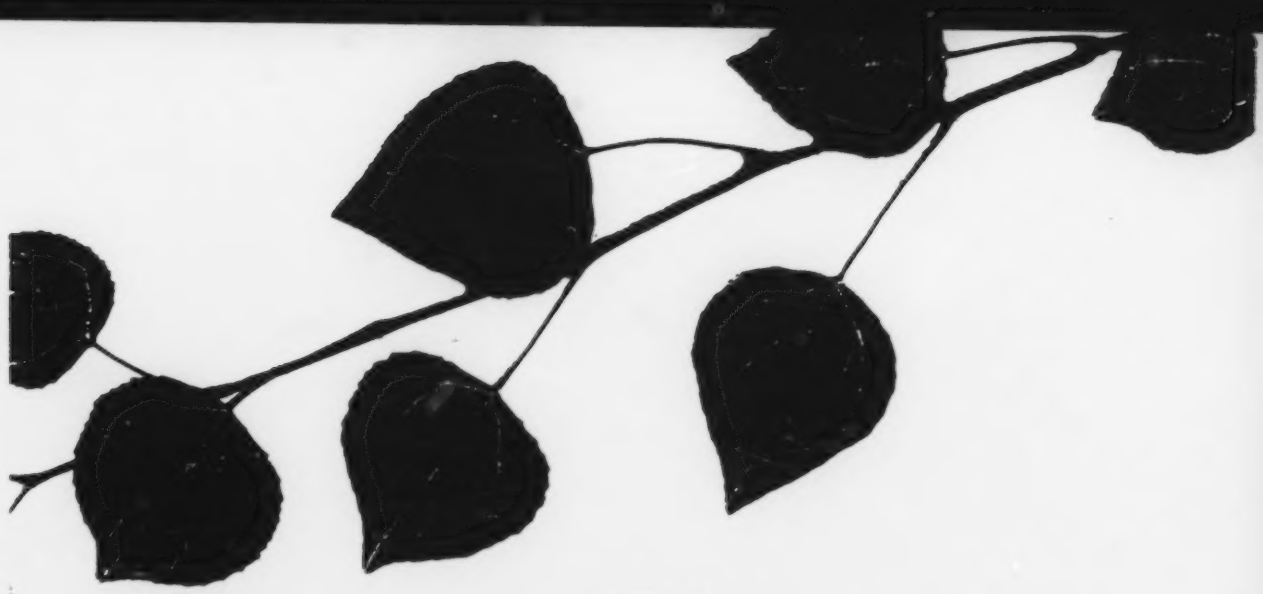
It is not enough to provide key constituencies and the general public with readable information about the present condition of mathematics, science and technology instruction. Every one of the SSI directors interviewed for this publication reiterated the importance of improving both the quality of information that is disseminated throughout the state and the opportunities for stakeholders and others to *respond* to what they have learned. The experiences of all of the SSIs confirm that the public needs relevant information and the opportunity to do something constructive with that information.

SSI

The challenge of making connections to the community while building strong alliances among K-12 teachers and institutions of higher education is formidable. The Arkansas SSI has addressed this issue by creating five regional mathematics and science partnerships throughout the state. These partnerships are housed at four universities and one education cooperative center. The institutes of higher education and other applicants for partnership sites agreed to provide adequate facilities, administrative and support staff, and waive any indirect costs normally associated with the receipt of grant funding. A mathematics and science coordinator was hired to direct each partnership center. Each coordinator works closely with a steering council consisting of education, business and civic representatives.

HOW: During the fall of 1994, all five coordinators spent a significant amount of time leading a variety of leadership and professional development activities. They interacted in some manner with the administrators of virtually ALL of Arkansas' 312 public school districts. They also visited many of the private K-12 institutions. The personal visits and attention built public and political support for mathematics and science education throughout the state and enlisted key leaders from business and the community.

A Community Relations Task Force — comprised of the SSI director, SSI staff, the community relations directors at three major television stations, and representatives from the state's largest banking institution, phone and power utility companies, three major Little Rock school districts, the Arkansas Press Association, Arkansas Outdoor Advertisers Association, Arkansas Radio Network, Arkansas Education Association, and the Public Relations Society of America — oversees communications. This group creates customized press releases about SSI activities in classrooms and districts and develops and distributes a quarterly state SSI newsletter. The SSI will reach a larger audience by developing a page on the World Wide Web on Internet, and exhibiting at business expos throughout Arkansas.



ENRICHING THE COOPERATION & COLLABORATION AMONG EDUCATORS

STRATEGY: CREATING VITAL CONNECTIONS AMONG ONGOING EDUCATION REFORM EFFORTS WITHIN A STATE TO MAXIMIZE THE BENEFIT OF EACH AND ELIMINATE UNNECESSARY DUPLICATION OF EFFORT

MSSION

Michigan Statewide Systemic Initiative

Michigan provides one of the best examples of an SSI leveraging the expertise of the statewide educational system. The Michigan Statewide Systemic Initiative (MSSI) played an instrumental role in creating the Teacher Education Framework Group. This group consists of teams from every public university in Michigan as well as a number of the state's private and community colleges. The MSSI convened these teams and asked them to examine their teaching practice in relation to the current thinking and research about teaching and learning.

HOW: Each team has six members representing higher education faculty who teach science and mathematics content courses, higher education faculty who teach mathematics and science teacher education courses and teacher leaders from the area public school system. A single representative from each university or college team serves on a steering committee for the Framework group which plans and guides the work of the network of teams. The full membership of the Teacher Framework Group meets several times a year.

During the first year, the Framework Group developed a document, *Guidelines for Science and Mathematics Teacher Preparation*, which describes its goals and strategies for implementation. The goals include: (1) transforming teaching to develop more powerful mathematics and science thinking in students, (2) developing essential supporting knowledge, (3) making science and mathematics accessible to all, and (4) building a culture of teaching as scholarship.

The Teacher Education Framework Group has already produced many changes in practice, including: several new courses in teacher education and mathematics and science; workshops on how to make large group instruction more engaging; strategies for ensuring new teachers can teach in diverse settings; stronger connections between higher education faculty and K-12 faculty to help meet the needs of all students; and refinements to the state process for university program approval.

QUEST

The publishing industry is one contributor to the reform of mathematics and science education that is frequently overlooked as individual states pursue increased student achievement. Virginia's Quality Education in Science and Education (QUEST) has engaged a multi-state consortium to establish the criteria and indicators for the development and selection of curricula, instructional materials and appropriate instructional technologies.

HOW: The multi-state consortium works with publishers of educational materials to clarify the alignment between higher expectations and learning standards and the material that is used with students and teachers. These conversations are leading to new print and technology-driven materials which will better serve the needs not only of Virginia but also of schools and students in many other states. The engagement of the publishing industry in the reform agenda can significantly reduce the duplication of effort that takes place within a single state's K-16 environment and also reach into other states, providing a clarity of goals which can otherwise take years to achieve.

IDENTIFYING THOSE EXISTING REFORMS THAT ARE IMPROVING STUDENT LEARNING AND FACILITATING THEIR SCALE-UP TO A GREATER NUMBER OF CHILDREN. USING EXISTING RESOURCES EFFICIENTLY TO SUPPORT THE SCALE-UP OF MATHEMATICS, SCIENCE AND TECHNOLOGY REFORM

South Dakota

National Science Foundation Systemic Initiative

Education reform is now a mainstay in the American public education system. The numerous federal, state, local and privately-funded reform initiatives underway are capable of touching every student in this country. The development of standards, benchmarks, professional standards and student outcomes at all levels of instruction is a common focus of many of these efforts. South Dakota is committed to providing its children with the finest education possible by maintaining a clear agenda which makes the best use of these various reform initiatives.

The SSI of South Dakota has always placed a high priority on collaboration among education stakeholders. The SSI is a key member of the state's Framework for Collaboration which brings together the efforts and interests of several reform agendas. Through the work of this group, South Dakota can create education policy which facilitates rather than hampers substantive, sustained school reform.

HOW: The South Dakota Framework for Collaboration met in January 1995 to discuss the various school reform initiatives and projects that were ongoing throughout the state. Included in this first meeting were representatives from seven education initiatives:

- The South Dakota Modernization Project
- The National Science Foundation Statewide Systemic Initiative
- The South Dakota Initiative for Challenging Standards
- Individuals responsible for the administration of the Elementary and Secondary Education Act
- Goals 2000: Educate America Act
- The South Dakota Tech Prep Initiative, and
- Representatives from the School to Work Opportunities Act.

Margo Heinert, the Project Director for the South Dakota SSI summed up the continuing mission of the group: "The purpose of this meeting was to begin a dialogue among the different representatives of each organization that deals with educational improvement initiatives in South Dakota. To make South Dakota's students competitive on a statewide basis as well as nationally and globally, greater coordination of resources in essential." The first meeting of the framework group created the groundwork for such cooperation.

THE SIMMS PROJECT

Montana's SIMMS (Systemic Initiative for Montana Mathematics and Science) has devoted much of its attention to redesigning the state mathematics curriculum and assessment strategies for grades 9-12. The SIMMS approach integrates a variety of disciplines into the study of mathematics. The SSI works closely with classroom teachers on best instructional practices, and is also developing an exemplary set of instructional materials which will soon be available to a national audience.

HOW: Johnny Lott, the co-director of SIMMS, notes that new curricular approaches do not always have the impact they should because they are not appropriately integrated. Teaching practice, instructional materials and assessment are addressed in isolation rather than in a cohesive systemic manner. SIMMS spent several years developing a refined mathematics curricula and supporting materials for grades 9-12 which has, as an essential component, innovative and multi-disciplinary evaluation techniques. As direct support from the National Science Foundation winds down, the Montana SSI is well-positioned to sustain activities with the revenue generated by the sale of these mathematics materials. A contract has been signed with a national publisher to produce and market the SIMMS mathematics project curriculum materials.

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STRATEGY DESIGNING EFFECTIVE STRUCTURES FOR CONTINUOUS COMMUNICATION BETWEEN AND AMONG SCHOOLS IN AN ERA OF LOCAL CONTROL AND DECENTRALIZATION

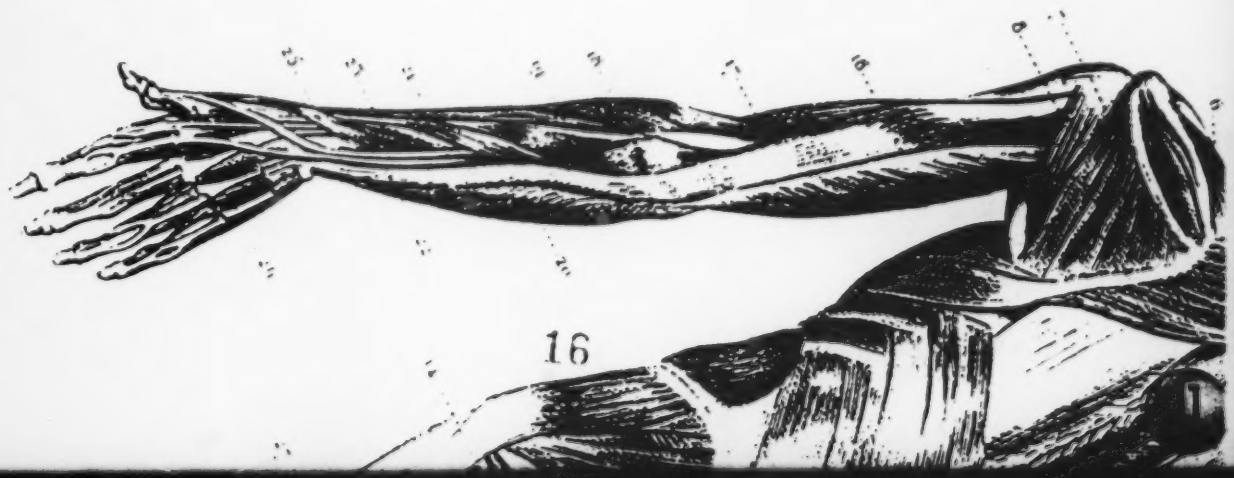
In an increasing number of states, school reform encompasses a wide variety of schooling choices and management structures. Collaborative decisionmaking, site-based management, school-centered budgeting, and an increase in charter schools are changing the landscape of education reform. The SSIs must address the increasingly critical need to build and support networks among schools and educational philosophies that are grounded in independence and committed to designing unique educational environments.

Perhaps this situation is no more obvious than in Texas — the nation's second largest state geographically and third largest in terms of population. The Texas SSI has created leadership teams to serve the specific needs and issues facing local school systems.

HOW: The Texas SSI is focusing on three main strategies to extend the depth and strength of service provided education institutions through the state. The strategies are to: (1) develop leadership teams that can address state and national issues on a local basis; (2) enhance the existing structures rather than create something new; and (3) provide the tools and resources the local leadership teams need to get their work done well.

The first strategy is to create efficient leadership teams that can identify an address the critical issues facing schools and districts. These emerging issues include: the need to include mathematics as a key component of Title I, redesigning algebra courses to increase student proficiency and strengthening preservice preparation and inservice opportunities for K-12 teachers.

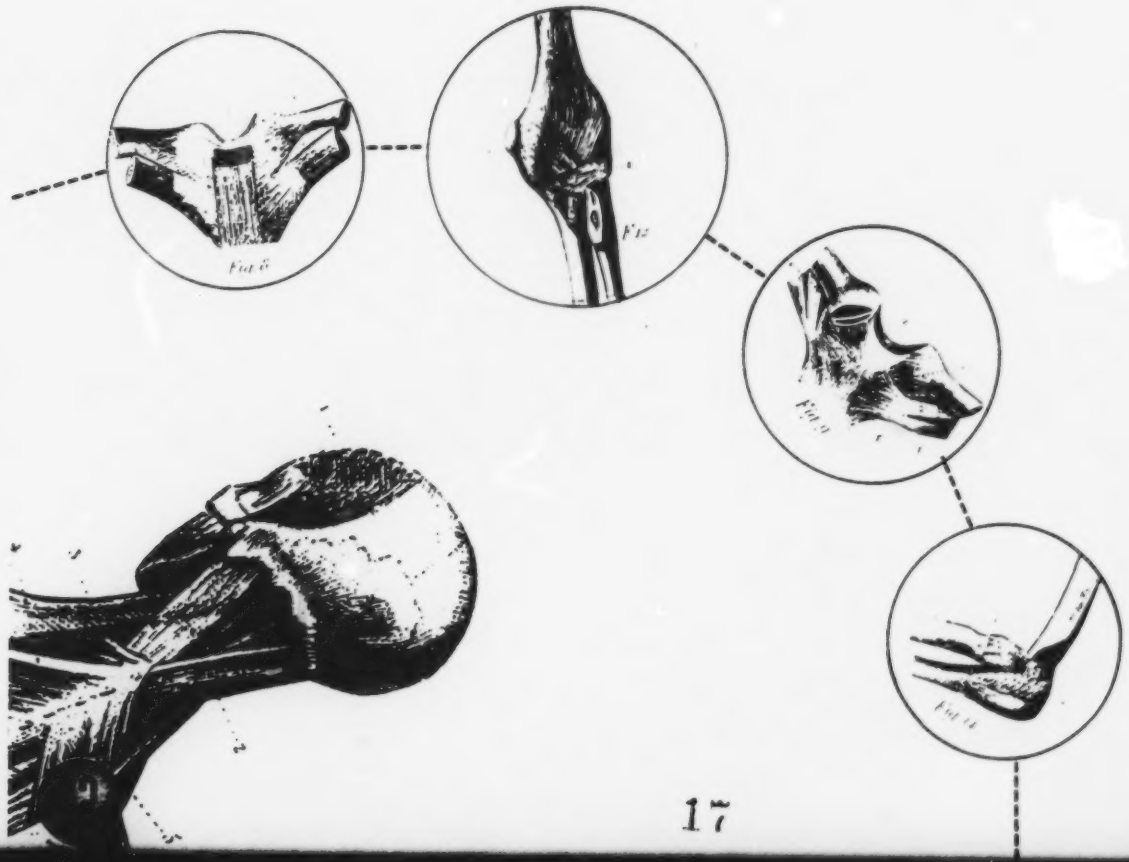
The Texas SSI works with 20 leadership teams from around the state to implement strategies two and three: to enhance existing structures and to provide the tools to get the job done. The Texas SSI coordinates discussions about critical issues, sponsors seminars of national significance, and provides the critical ongoing resource and technical support the leadership teams need to implement effectively the strategies they have developed in collaboration with their peers from across Texas. The Texas SSI structure facilitates open and continuous conversation among critical constituents and stakeholders who have the opportunity to improve MST education for all students.



SSI New York State Systemic Initiative

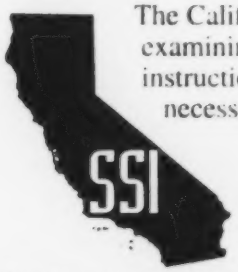
The New York State Systemic Initiative began with a commitment to address the schools with the greatest needs — those located in the state's six largest urban districts. The SSI's goal is to establish a restructured system of K-8 education in mathematics, science and technology. A key strategy to achieve this goal is the development of ten Research and Demonstration (R&D) schools across the six districts. These schools serve as "learning labs" for how urban district policies and practices should support MST education reform. SSI efforts occur within the context of state policy — *A New Compact for Learning* — which is a set of aligned policies to support state standards.

HOW: The SSI selected ten schools, representative of disadvantaged schools in each district, as R&D schools through an RFP process. Each school organized a leadership team to provide support for mathematics, science and technology teaching and learning. Each team included three to five lead mathematics and science teachers, an SSI principal investigator, a district-level liaison, a district SSI coordinator, the school principal, higher education coaches and an SSI evaluator. The team provides assistance to school staff in implementing a standards-based mathematics and science inquiry curriculum *and* links what is being learned about school reform back to the district. The district can use this information to reexamine how its policies, routines and procedures support school-based reform. Districts are focusing on vision and planning, the development of curriculum and other materials, removing barriers, professional development and other supports for school change. The lessons these districts and the R&D schools learn will inform the strategies to expand reform to other schools in the districts and, ultimately, to other districts in the state.



STRATEGY: BUILDING THE CAPACITY OF TEACHERS AND ADMINISTRATORS THROUGH EFFECTIVE MODELS OF PROFESSIONAL DEVELOPMENT

Effective and continuous professional development is a major goal of nearly every SSI. The rapid transition of technology from an instrument of teaching to a process for learning has caused both anxiety and excitement among teachers. Several states, such as Michigan and New Jersey, are making a comprehensive shift in the scope and nature of professional development. Rather than focusing on one or two inservices, these and other SSIs are in the process of creating regional centers, academies, and resource libraries that will better serve the long-term needs of classroom teachers.



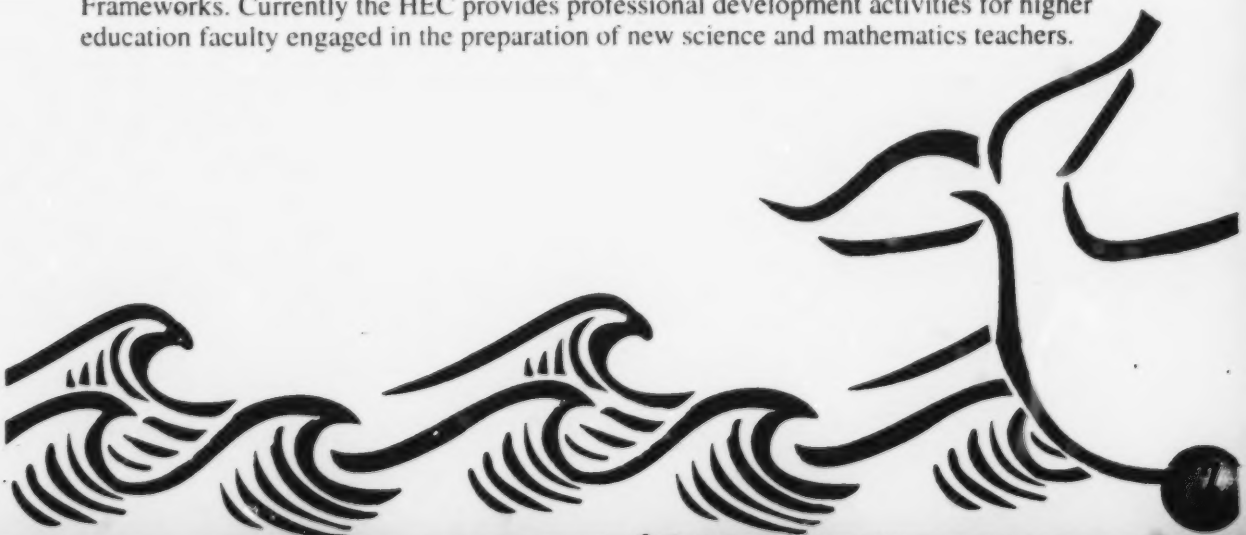
The California SSI has created a network of over 1,000 schools engaged in examining current practice, designing changes in mathematics and science instruction as appropriate, and building the development opportunities and support necessary to achieve success.

HOW: Schools in the SSI network have made internal changes to move from dated curricula and less effective instructional techniques to more dynamic learning environments that engage students and teachers in a collaborative drive for knowledge. To support these efforts, the California SSI created a professional development model which provides four weeks of training for lead teachers. The lead teachers then return to their home schools prepared to work with their faculties and the SSI in designing and providing at least 500 additional hours of school-based professional development in the schools. Schools participating in the process receive additional financial and technical support as they develop curriculum materials which can be used in their schools and also disseminated by the SSI to other schools throughout California.

DISCOVER SCIENCE IN FLORIDA

Discover Science and Mathematics in Florida, has kept professional development as a primary goal since its creation in 1991. As with many of the SSIs, Florida is not limiting professional activities to K-12 classrooms. Rather, Florida is concentrating on the nature of science and mathematics content and teaching at the college level, reaching both preservice and inservice teachers.

HOW: Florida created the Higher Education Consortium for Science and Mathematics Education (HEC) with the mission of facilitating communication among educational institutions to enhance mathematics and science education and learning. HEC hopes to make significant improvements in postsecondary instruction in both teacher preparation and teacher enhancement, using the goals of the SSI, Blueprint 2000 and Florida's Science and Mathematics Curriculum Frameworks. Currently the HEC provides professional development activities for higher education faculty engaged in the preparation of new science and mathematics teachers.

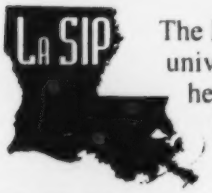


Project 21

The Delaware SSI targets professional development to support standards-based reform. Development activities range from illustrations of the standards to strategies for school change needed to support new training and learning. The SSI developed this set of criteria for professional development activities based on research and best practice:

- Content focused
- Ongoing and sustained
- Promotes active engagement between and among all participants
- Job embedded, providing maximum return on the participant's time and energy
- Systemic
- Provides participants time to actively reflect on what has been learned and how the knowledge can be applied to their own efforts to improve mathematics and science education.

HOW: Member schools enter into cooperative agreements with the SSI as "New Directions Development Sites." Supported by SSI coaches, they develop, pilot or adapt mathematics and science units. Participants deepen their skills through ongoing action research groups, regional and statewide workshops and an intensive summer institute. All SSI activities model the professional development criteria. The RFP through which districts apply for new state professional development funds also incorporates the criteria. The criteria are being used as a part of the RFP for districts to access new state monies designated for professional development.



The Louisiana Systemic Initiative Program, LaSIP, acts as a catalyst to encourage universities and school systems to make effective and lasting partnerships. The heart of LaSIP is professional development for classroom teachers. Although the SSI focuses on all aspects of systemic change, LaSIP devotes 70% of its resources to teachers' professional development.

HOW: The LaSIP professional development model has three components: (1) intensive, content-rich, classroom-focused summer work; (2) carefully organized follow-up during the academic year; and (3) a site coordinator with extensive classroom experience who bridges the gap between university faculty and participants. Local sites compete for project funding and projects must feature collaboration between school districts and universities. Over 800 teachers each year participate in 150 to 200 hours of professional development activities. The NSF-funded Louisiana Collaborative for Excellence in the Preparation of Teachers is closely linked to LaSIP. The collaborative funds nineteen year-long Campus Renewal Projects to develop innovative curricula and methodology. These projects enhance the preparation of mathematics and science teachers as LaSIP works with teachers who are currently in the classroom.

STRATEGY ASSURING EQUITABLE OUTCOMES AND OPPORTUNITIES FOR ALL STUDENTS

Improving access to high performing classes for all students is key to securing dramatic improvements in the quality of mathematics and science education. The SSIs are committed to eliminating the achievement gap between "mainstream" groups and "underrepresented" groups while raising the level and knowledge and skills of all students.

NJ/SSI

The New Jersey SSI began its work with a clear look at the sixth year of the initiative and how energy and commitment could be sustained beyond NSF's funding. Toward this end, New Jersey engaged a strong coalition of schools, universities and stakeholder organizations in a successful attempt to institutionalize SSI activities from the outset. Equity is a critical agenda. To support it, the SSI created a self-study to help districts explore causes of performance and achievement differences and to infuse equity objectives and strategies in their overall plans for systemic reform.

HOW: The New Jersey process for achieving equity in mathematics and science courses begins by engaging the school community in a critical self-evaluation of its efforts — past and present — to advance equity. With this background, and with technical and additional support from the SSI, districts begin the task of dismantling those parts of the system that produce inequity. Working with their constituencies, the districts design strategies that the entire staff—from administration, to counselors, and to classroom teachers and aides — will employ to encourage the participation of students from groups where achievement has been limited. The schools may call on all of the resource partners within the SSI as they undertake this work.

VISMT

The Vermont Institute for Science, Mathematics and Technology (VISMT) faced the equity issue head on when it created the VISMT Equity Advisory Committee. The mission of this committee is to "promote equal opportunities for learning in science, mathematics and technology by removing inequities based on gender, race, socioeconomic status, ethnicity, disabilities and other factors that may affect students' learning and self-esteem."

HOW: To support the critical goal of equal access and opportunity for success, the Equity Advisory Committee created a set of Equity Benchmarks which schools can use to gauge their own progress toward increased educational opportunity for all students. The benchmarks fall into seven categories:

- School and Classroom Climate
- Curriculum
- Assessment
- Professional Development
- Management and Governance
- Community Outreach, and
- Access to Technology.

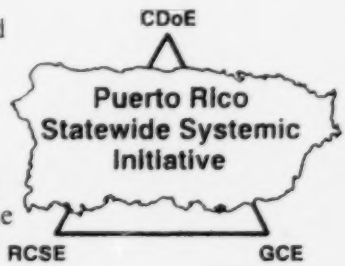
The benchmarks, together with an "Equity Reality Check" developed by VISMT, provide schools and districts throughout Vermont with the means to evaluate their present standing on equity issues and create a course for improvement. VISMT offers technical support.

The Georgia Initiative in Mathematics and Science (GIMS) targets diversity as a core issue in every SSI effort. GIMS seeks to not only to increase minority participation but to challenge and change cultural expectations and limitations regarding achievement in MST education and professions. GIMS hopes to replace the current learning climate with one that embraces cultural diversity, that expects and demands high achievement from all students and that encourages all children to excel.

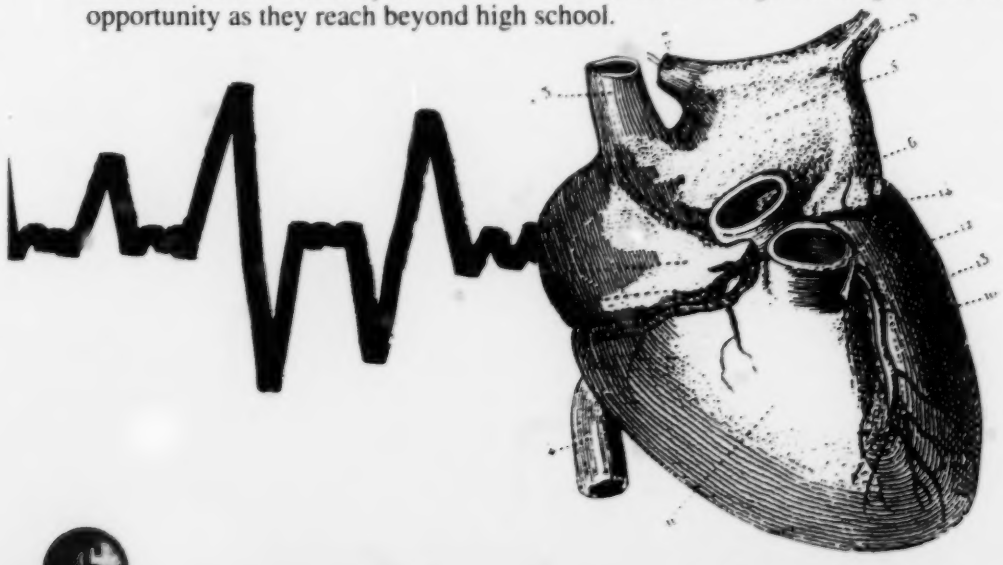
HOW: Diversity and high expectations for all students link the three major goal clusters of GIMS: (1) curriculum, assessment and instruction, (2) teacher preparation and (3) a system of support. A GIMS-sponsored statewide symposium produced a consensus on a common definition of diversity. This definition provided a foundation for the mission statement of GIMS and a Conceptual Framework for Diversity. The conceptual framework, in turn, supported the development of an audit instrument used to assess the diversity climate of schools and colleges. Audit results will help inform extensive professional development efforts.

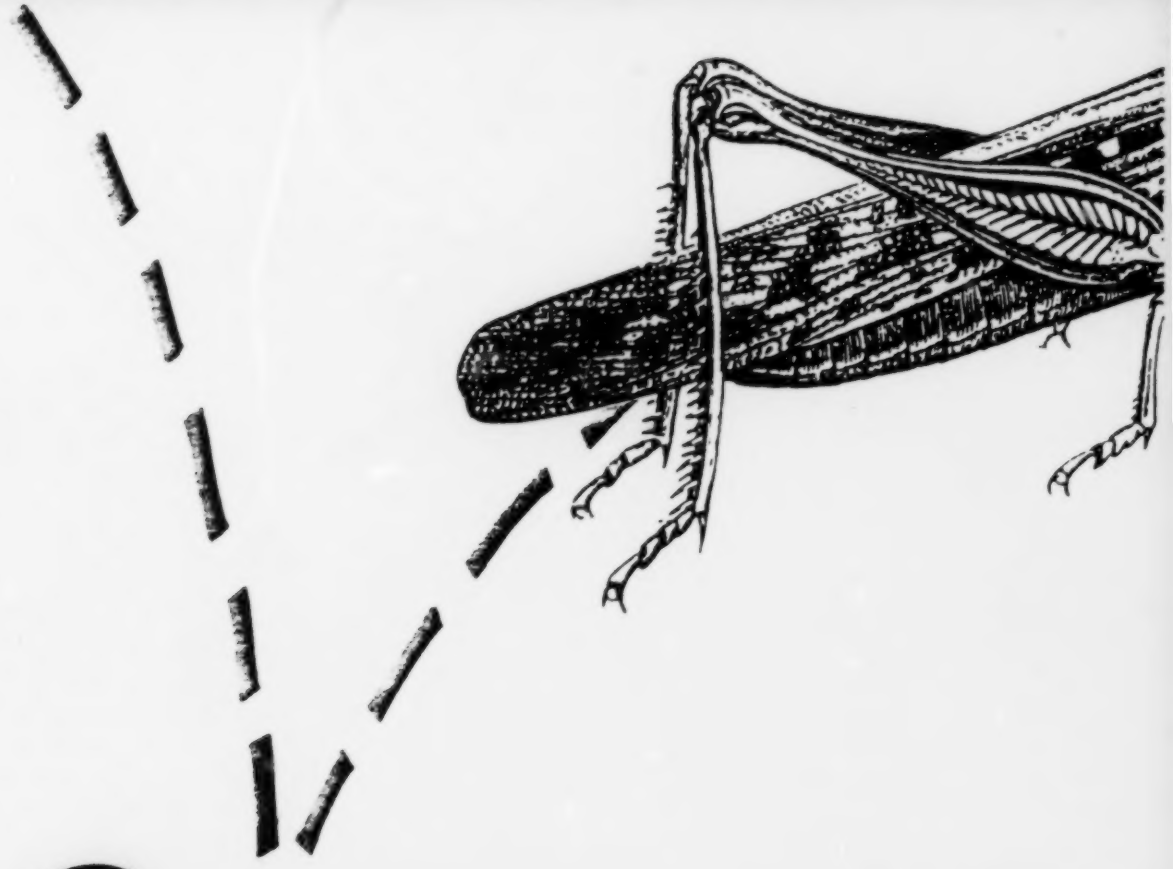
Besides the framework and the audit instrument, GIMS produced a diversity video to increase public awareness of, and engage public support for, the diversity goal. GIMS is currently working on a multimedia resource library to house information and research on diversity. The SSI also is planning to establish a cadre of state leaders who will provide vision and commitment in carrying out the framework.

The Puerto Rico SSI focuses the collaborative efforts of the Puerto Rico Department of Education, the Resource Center for Science and Engineering and the Puerto Rico General Council on Education to provide educational excellence in science and mathematics for all K-12 students. The SSI is revising the mathematics and science curriculum by focusing on hands-on activities that follow a constructivist approach, and the development of students as "active learners" to boost their motivation and self-concept. One strategy the Puerto Rico SSI is using to support the curriculum revision and equitable opportunity for all students is the publication of StarQuest.



HOW: Through collaboration with the University of Puerto Rico and the *San Juan Star*, a two-page section of the newspaper will be developed and produced as a teaching tool for ninth grade students. Beyond providing students with interesting mathematics and science activities, *StarQuest* also is designed to help students further develop their literacy in English. The inclusion of basic language and literacy activities in this weekly publication will help all students raise their level of literacy in several content areas, assuring them of greater academic opportunity as they reach beyond high school.





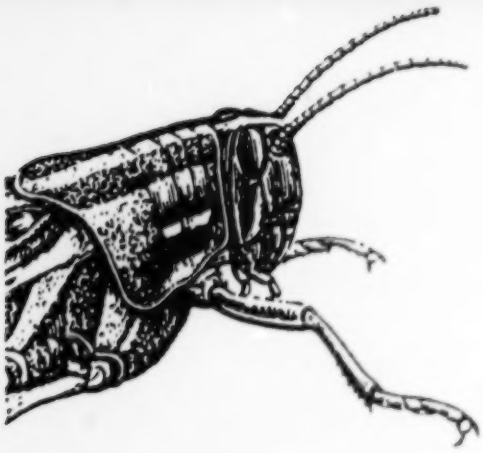
STRATEGY: COLLECTING AND DISSEMINATING EVIDENCE THAT DEMONSTRATES THE POTENTIAL AND SUCCESS OF VARIOUS REFORMS IN MATHEMATICS, SCIENCE AND TECHNOLOGY

Many of the SSIs pay great attention to the process of demonstrating the effectiveness of MST education reforms. Clearly, public and political support for education reform hinges on continuous and accurate documentation of effectiveness. All of the SSIs have built into their mission and structure a process for evaluating and discussing the success of various reform measures.

KENTUCKY PRISM

Kentucky's legislature has invested considerable leadership, time and resources in improving education within the state. The PRISM project, Kentucky's statewide systemic initiative, is instrumental in providing guidance to policymakers, education leaders, teachers and parents as they collaboratively design appropriate expectations for the students of the state.

HOW: Rather than writing assessment standards to conform to the existing curricula in mathematics and science, Kentucky's approach was to first examine the broad learning goals and outcomes they expect their children to achieve. Kentucky then constructed appropriate forms of assessment which combine traditional testing measures with assessments that expect students to demonstrate their achievement of the learning goal through a variety of age-appropriate activities. With learning goals and assessment strategies in place, a collaborative group of teachers, parents, scholars, researchers and policymakers examined the existing curricula, making changes where necessary to assure a proper alignment of goals, outcomes, assessment strategies and curricula. Individual districts and schools develop their local curricula based on the state framework.

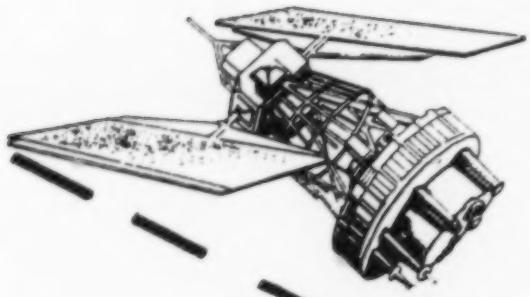


CONNECT Colorado's SSI, CONNECT, has designed its evaluation plan to support its collaborative model of systemic change. Colorado, a strong local control state, uses both a top-down and bottom-up approach to improving mathematics, science and technology education for all students. Recent state laws regarding the development of content standards and teacher licensure provide a common policy context for the SSI, but twelve collaboratives made up of districts, community members and organizations and an institution of higher education, have the autonomy to implement reform plans based on local standards that meet or surpass the state standards. Because so much discretion is given to the collaboratives, the benchmarks of the evaluation plan provide a framework for linking both state and local efforts.

HOW: CONNECT created 15 benchmarks to assess annual progress of the SSI collaboratives. The benchmarks are based on the *Intermediate Benchmarks for Systemic Reform in Mathematics and Science Education*, developed jointly by the U.S. Department of Education and the National Science Foundation, the funding requirements of the Goals 2000 and the desired outcomes of CONNECT. The benchmarks cover five major areas of systemic change including: aligning the education system around the mathematics and science content standards, systemic linkages, scale-up, equity and technology. The benchmarks are flexible enough to accommodate local approaches and yet keep the entire effort focused on systemic change.

Discovery Project Discovery, Ohio's Statewide Systemic Initiative, created a Landscape Study which will provide the SSI staff, Ohio's education leaders and key state policymakers with detailed information about the success of mathematics and science reforms throughout the state.

HOW: In order to conduct this sweeping study of program effectiveness and correlates of student achievement, Discovery asked principals, teachers, parents and students across Ohio to respond to questionnaires. In addition, with the assistance of its external evaluator, student achievement data were culled from the Discovery Inquiry Tests for mathematics and science. These Ohio-SSI designed tests, which were given to students of both Discovery and non-Discovery teachers, were based on the National Assessment of Educational Progress (NAEP) public release items. This evaluation strategy has produced a clear picture of past and present classroom practice and expectations as well as significant information that will be used to chart the future course of mathematics and science instruction in Ohio.



STRATEGY ENSURING LONG-TERM FINANCIAL SUPPORT FOR SCALE-UP

CONNSTRUCT

The National Science Foundation intends the SSIs to continue their work with state or other financial support after the five-year funding cycle ends. Many SSIs have strategies in place to sustain their efforts. Connecticut focused on this issue from the outset and developed a long-term plan for identifying new funding sources consistent with program needs and objectives. Connecticut's business community has been engaged in the work of the SSI from the time the proposal to the NSF was being written.

HOW: CONNSTRUCT, the Connecticut SSI, created a business plan that extends to the year 2000. Beginning in June 1995, CONNSTRUCT leadership will present "Educational Investment Proposals" to some of the largest foundations and corporations in the state. These proposals will reflect both objectives of the SSI and sponsorship priorities of the individual donors.

The business plan targets specific reform issues — such as the lack of time for teachers to plan adequately and Connecticut's standing in international comparison studies — and seeks capital investments to address them. The organizations that choose to invest will have an opportunity to participate in developing the objectives and implementing strategies to address barriers to reform. The funding also will create a mechanism to reallocate public resources that are not currently showing a return on investment in terms of student performance and teacher development.

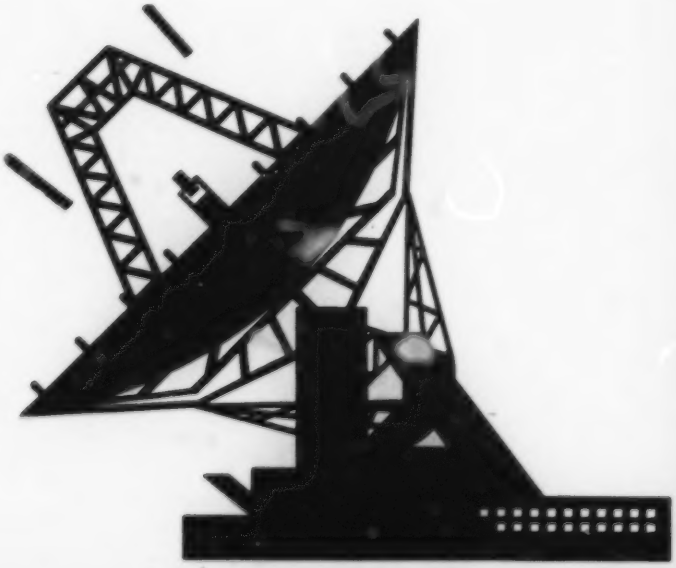
CONCLUSION

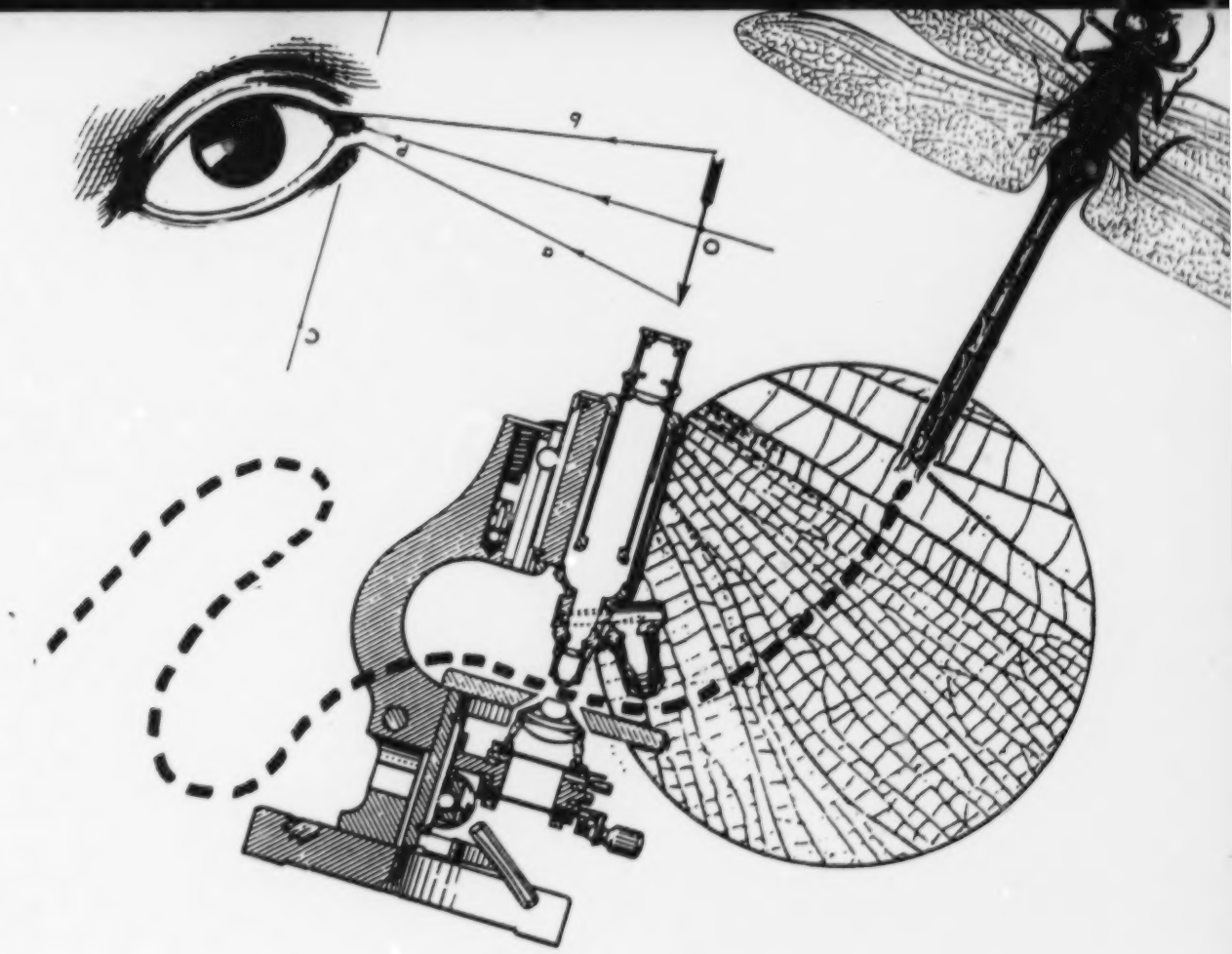
This document profiles only some of the exemplary strategies the SSIs are employing to scale-up and strengthen mathematics, science and technology education. They can inform efforts by others who want to improve the quality of education in their states.

But, as each of the SSI states will confirm, implementation of statewide systemic changes in MST education is the beginning, and not the end, of a long-term process of reform. Those involved in New Mexico's SSI in Mathematics and Science Education well-described this process when they referred to one earlier reform initiative, Re:Learning, as plowing the field of reform and other initiatives, such as the SSI, as sowing the seeds of effective change.

The nation has been at the business of reform since this year's high school graduates entered Kindergarten. Some states have been tackling school reform for even longer. Millions of dollars have been allocated at all levels of instruction and governance, seeking substantive solutions to the issues of declining student performance, inadequate teacher preparation, missed opportunities in professional development and a growing concern that this country is losing its competitive edge in an increasingly global economy. States and local communities are stepping up to these issues but they will not succeed if the reform momentum is lost.

The next step for policymakers, their constituents and every educator is to build on the investments that have already been made in school reform, scale-up those strategies that have proved effective and continue to create strong networks of policymakers, education leaders, constituents, teachers, parents and students willing to maintain the commitment to reform created through opportunities such as the National Science Foundation's Statewide Systemic Initiative.





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David Yeager undertook the intensive work of interviewing each SSI director, reviewing their materials and writing this report; Anna West produced the final copy; and Debra Komodore did the graphic design.

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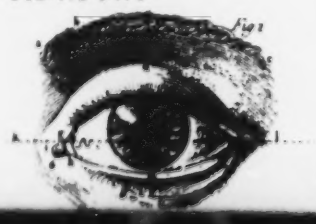

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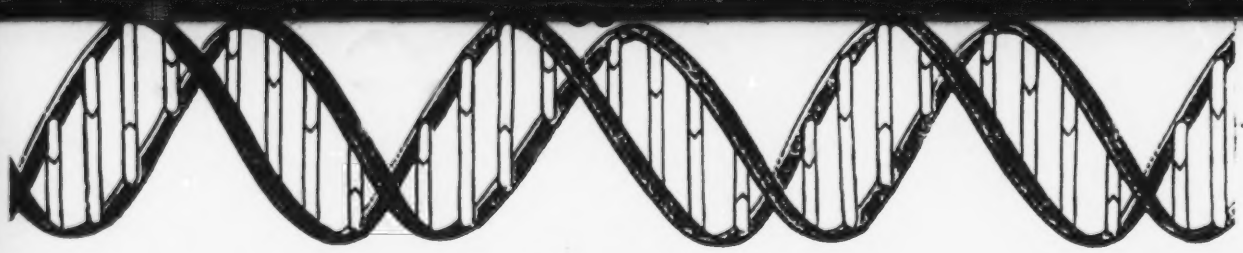

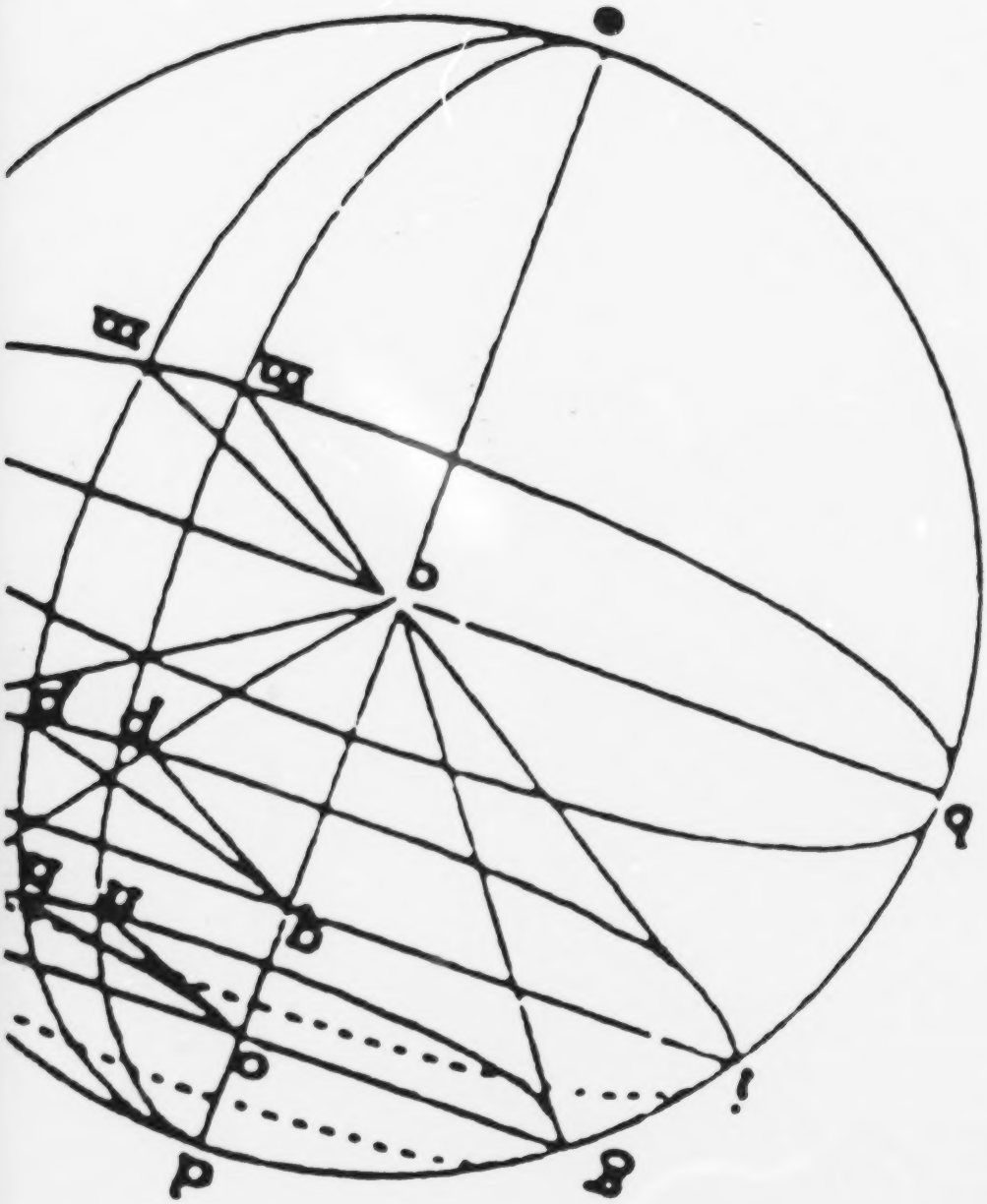
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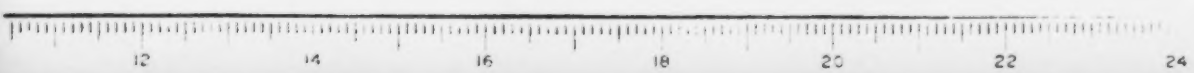
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